



# STGD3NB60SD

## N-CHANNEL 3A - 600V DPAK Power MESH™ IGBT

### PRELIMINARY DATA

TYPE	V <sub>CES</sub>	V <sub>CE(sat)</sub>	I <sub>C</sub>
STGD3NB60SD	600 V	< 1.5 V	3 A

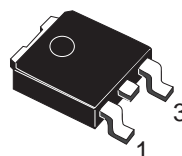
- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- VERY LOW ON-VOLTAGE DROP (V<sub>cesat</sub>)
- HIGH CURRENT CAPABILITY
- OFF LOSSES INCLUDE TAIL CURRENT
- INTEGRATED FREEWHEELING DIODE
- SURFACE-MOUNTING DPAK (TO-252)  
POWER PACKAGE IN TAPE & REEL  
(SUFFIX "T4")

### DESCRIPTION

Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances. The suffix "S" identifies a family optimized to achieve minimum on-voltage drop for low frequency applications (<1kHz).

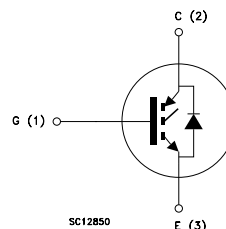
### APPLICATIONS

- GAS DISCHARGE LAMP
- STATIC RELAYS
- MOTOR CONTROL



**DPAK  
TO-252**  
(Suffix "T4")

### INTERNAL SCHEMATIC DIAGRAM



### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>CES</sub>	Collector-Emitter Voltage (V <sub>GS</sub> = 0)	600	V
V <sub>GE</sub>	Gate-Emitter Voltage	± 20	V
I <sub>C</sub>	Collector Current (continuous) at T <sub>c</sub> = 25 °C	6	A
I <sub>C</sub>	Collector Current (continuous) at T <sub>c</sub> = 100 °C	3	A
I <sub>CM</sub> (•)	Collector Current (pulsed)	25	A
P <sub>tot</sub>	Total Dissipation at T <sub>c</sub> = 25 °C	48	W
	Derating Factor	0.32	W/°C
T <sub>stg</sub>	Storage Temperature	-65 to 175	°C
T <sub>j</sub>	Max. Operating Junction Temperature	175	°C

(•) Pulse width limited by safe operating area

## STGD3NB60SD

### THERMAL DATA

R <sub>thj-case</sub>	Thermal Resistance Junction-case	Max	3.125	°C/W
R <sub>thj-amb</sub>	Thermal Resistance Junction-ambient	Max	100	°C/W
R <sub>thc-sink</sub>	Thermal Resistance Case-sink	Typ	1.5	°C/W

### ELECTRICAL CHARACTERISTICS (T<sub>j</sub> = 25 °C unless otherwise specified)

#### OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>BR(CES)</sub>	Collector-Emitter Breakdown Voltage	I <sub>C</sub> = 250 µA V <sub>GE</sub> = 0	600			V
I <sub>CES</sub>	Collector cut-off (V <sub>GE</sub> = 0)	V <sub>CE</sub> = Max Rating T <sub>j</sub> = 25 °C V <sub>CE</sub> = Max Rating T <sub>j</sub> = 125 °C			10 100	µA µA
I <sub>GES</sub>	Gate-Emitter Leakage Current (V <sub>CE</sub> = 0)	V <sub>GE</sub> = ± 20 V V <sub>CE</sub> = 0			± 100	nA

#### ON (\*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>GE(th)</sub>	Gate Threshold Voltage	V <sub>CE</sub> = V <sub>GE</sub> I <sub>C</sub> = 250 µA	2.5		5	V
V <sub>CE(SAT)</sub>	Collector-Emitter Saturation Voltage	V <sub>GE</sub> = 15 V I <sub>C</sub> = 1.5 A V <sub>GE</sub> = 15 V I <sub>C</sub> = 3 A V <sub>GE</sub> = 15 V I <sub>C</sub> = 3 A T <sub>j</sub> = 125 °C		1 1.2 1.1	1.5	V V V

### DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub>	Forward Transconductance	V <sub>CE</sub> = 25 V I <sub>C</sub> = 3 A	1.7	2.5		S
C <sub>ies</sub> C <sub>oes</sub> C <sub>res</sub>	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V <sub>CE</sub> = 25 V f = 1 MHz V <sub>GE</sub> = 0		255 30 5.6	330 40 7	pF pF pF
Q <sub>G</sub> Q <sub>GE</sub> Q <sub>GC</sub>	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	V <sub>CE</sub> = 480 V I <sub>C</sub> = 3 A V <sub>GE</sub> = 15 V		18 5.4 5.5		nC nC nC
I <sub>CL</sub>	Latching Current	V <sub>clamp</sub> = 480 V R <sub>G</sub> = 1kΩ T <sub>j</sub> = 150 °C	12			A

### SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t <sub>d(on)</sub> t <sub>r</sub>	Delay Time Rise Time	V <sub>CC</sub> = 480 V I <sub>C</sub> = 3 A V <sub>GE</sub> = 15 V R <sub>G</sub> = 1kΩ		125 150		ns ns
(di/dt) <sub>on</sub>	Turn-on Current Slope	V <sub>CC</sub> = 480 V I <sub>C</sub> = 3 A R <sub>G</sub> = 1kΩ V <sub>GE</sub> = 15 V		50		A/µs
E <sub>on</sub>	Turn-on Switching Losses	T <sub>j</sub> = 125 °C		1100		µJ

**ELECTRICAL CHARACTERISTICS** (continued)**SWITCHING OFF**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_c$	Cross-Over Time	$V_{CC} = 480\text{ V}$ $I_C = 3\text{ A}$		1.8		$\mu\text{s}$
$t_r(V_{off})$	Off Voltage Rise Time	$R_{GE} = 1\text{ k}\Omega$ $V_{GE} = 15\text{ V}$		1.0		$\mu\text{s}$
$t_{d(off)}$	Delay Time			3.4		$\mu\text{s}$
$t_f$	Fall Time			0.72		$\mu\text{s}$
$E_{off(**)}$	Turn-off Switching Loss			1.15		mJ
$t_c$	Cross-Over Time	$V_{CC} = 480\text{ V}$ $I_C = 3\text{ A}$		2.8		$\mu\text{s}$
$t_r(V_{off})$	Off Voltage Rise Time	$R_{GE} = 1\text{ k}\Omega$ $V_{GE} = 15\text{ V}$		1.45		$\mu\text{s}$
$t_{d(off)}$	Delay Time	$T_j = 125\text{ }^\circ\text{C}$		3.6		$\mu\text{s}$
$t_f$	Fall Time			1.2		$\mu\text{s}$
$E_{off(**)}$	Turn-off Switching Loss			1.8		mJ

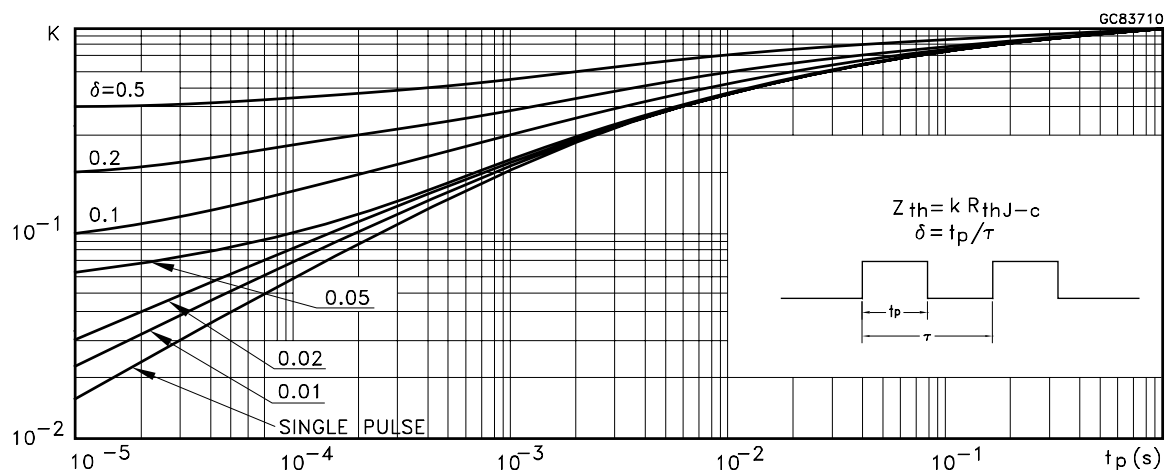
**COLLECTOR-EMITTER DIODE**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_f$	Forward Current				3	A
$I_{fm}$	Forward Current pulsed				25	A
$V_f$	Forward On-Voltage	$I_f = 3\text{ A}$		1.55	1.9	V
		$I_f = 1\text{ A}$		1.15		V
$t_{rr}$	Reverse Recovery Time	$I_f = 3\text{ A}$ $V_R = 200\text{ V}$		1700		ns
$Q_{rr}$	Reverse Recovery Charge	$dI/dt = 100\text{ A}/\mu\text{S}$ $T_j = 125\text{ }^\circ\text{C}$		4500		nC
$I_{rrm}$	Reverse Recovery Current			9.5		A

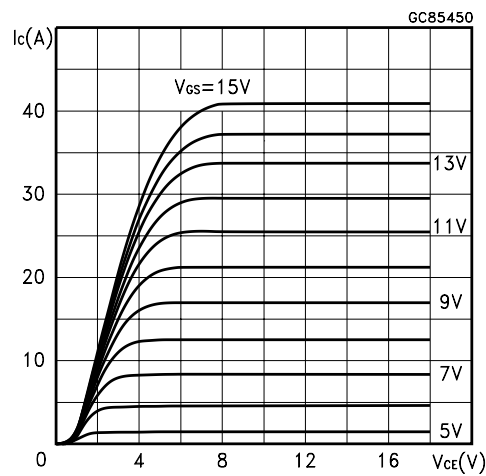
(•) Pulse width limited by max. junction temperature

(\*) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %

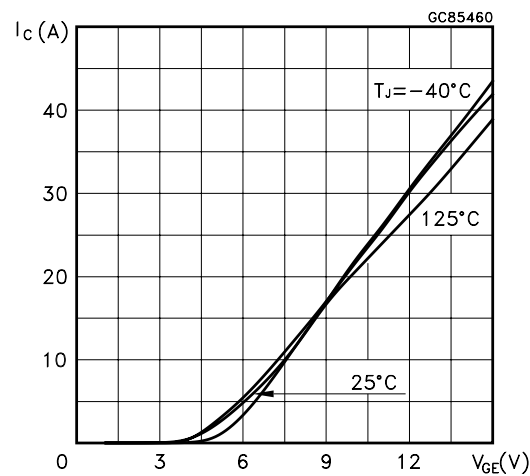
(\*\*) Losses Include Also The Tail (Jedec Standardization)

**Thermal Impedance**

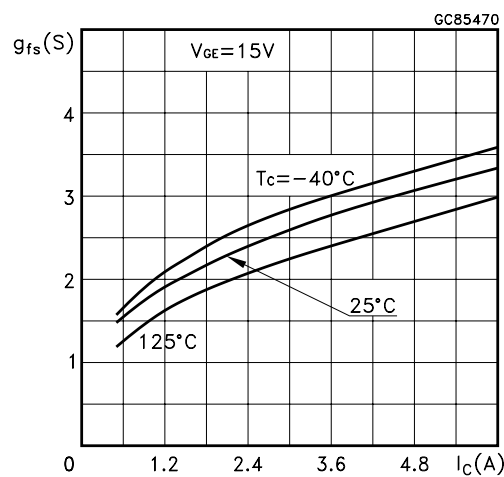
Output Characteristics



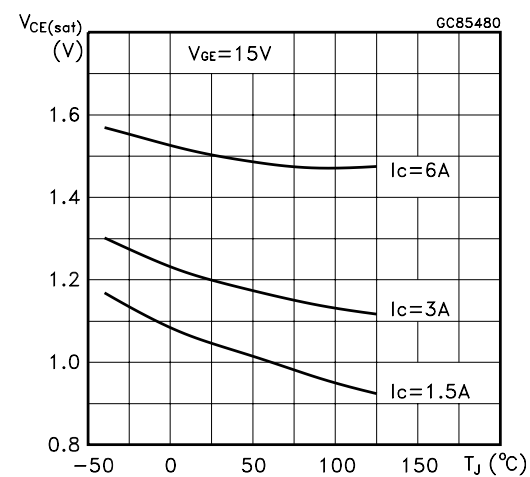
Transfer Characteristics



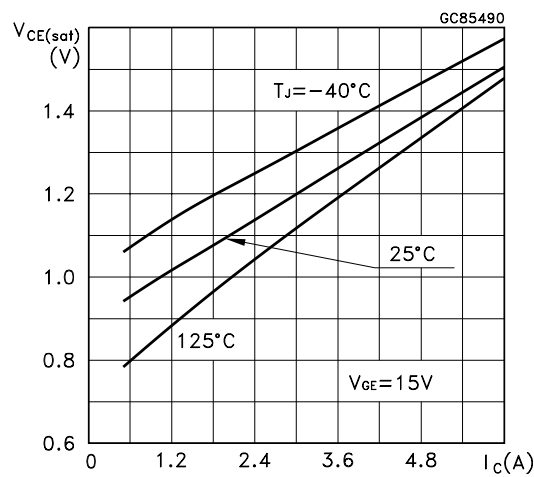
Transconductance



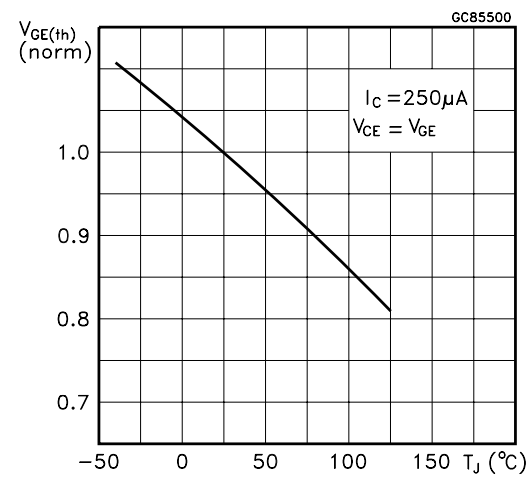
Collector-Emitter On Voltage vs Temperature



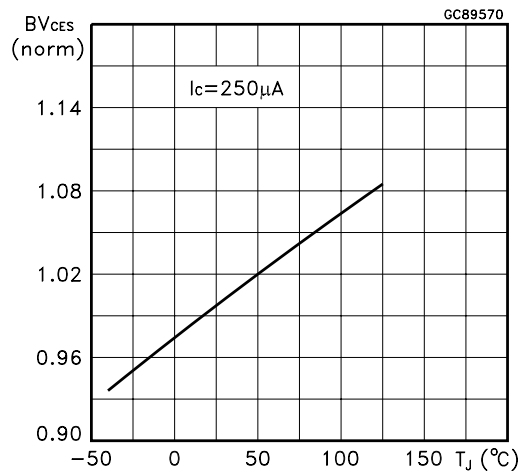
Collector-Emitter On Voltage vs Collector Current



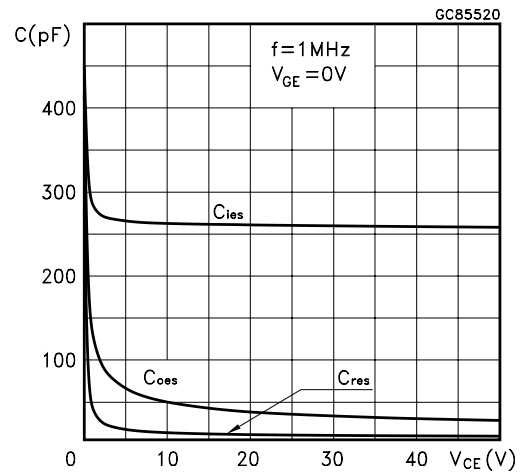
Gate Threshold vs Temperature



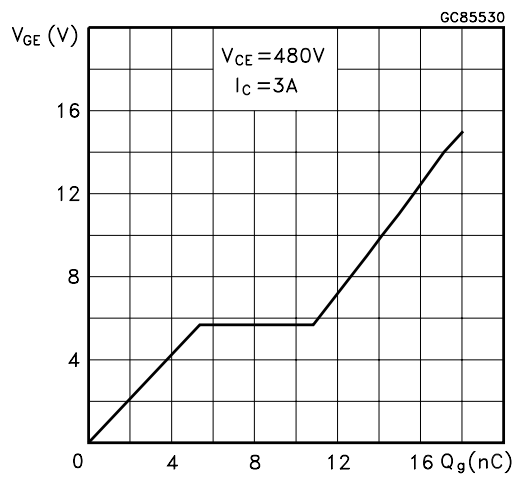
Normalized Breakdown Voltage vs Temperature



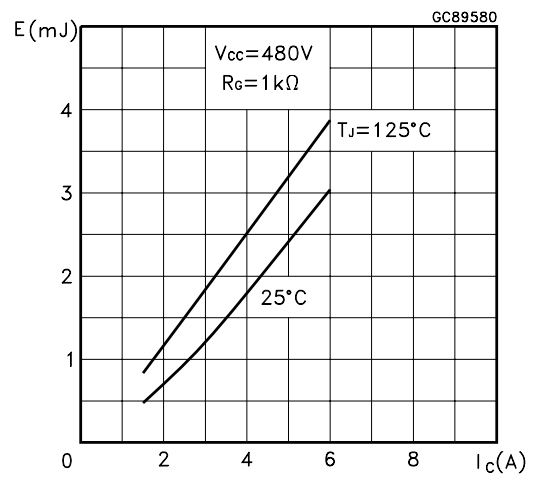
Capacitance Variations



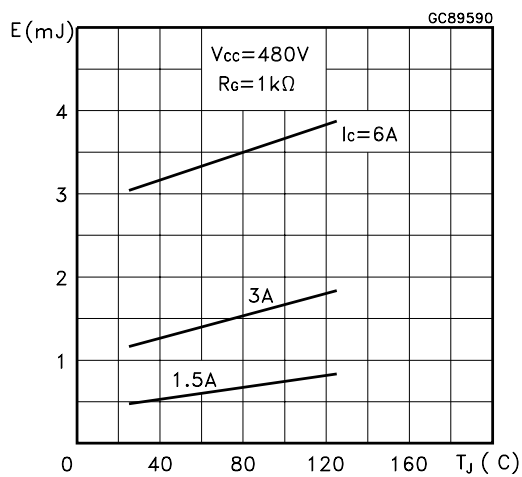
Gate Charge vs Gate-Emitter Voltage



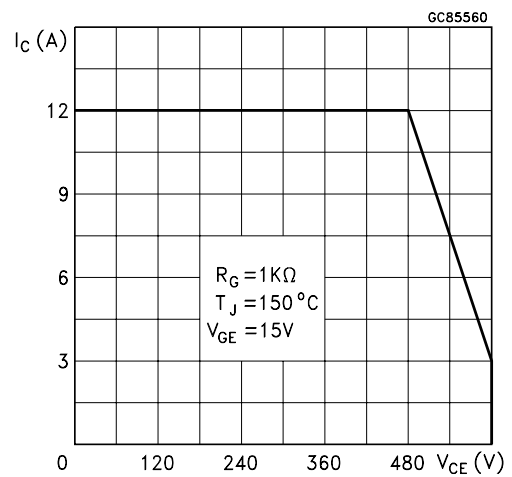
Off Switching Losses vs  $I_C$



Off Switching Losses vs  $T_J$



Switching Off Safe Operatin Area



Diode Forward vs Tj

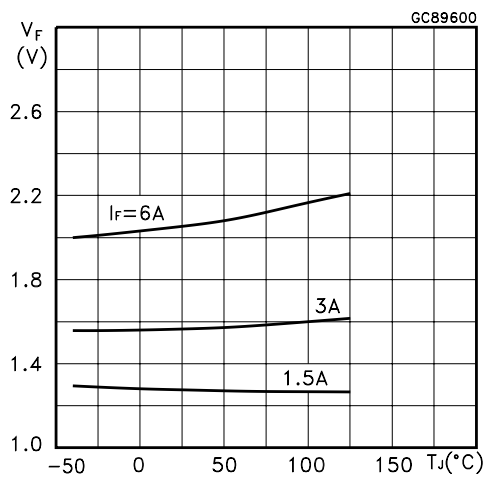


Fig. 1: Gate Charge test Circuit

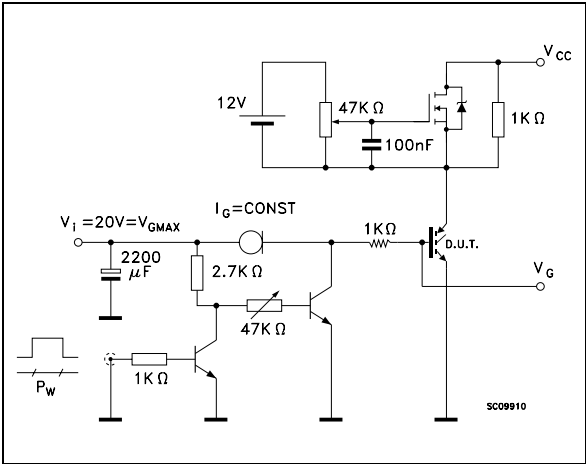
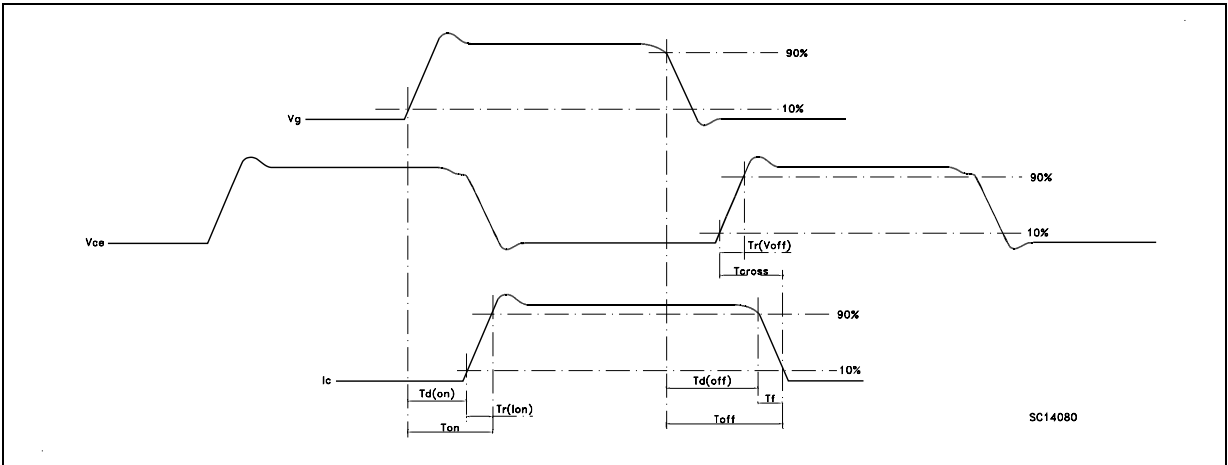


Fig. 3: Switching Waveforms



Diode Forward Voltage

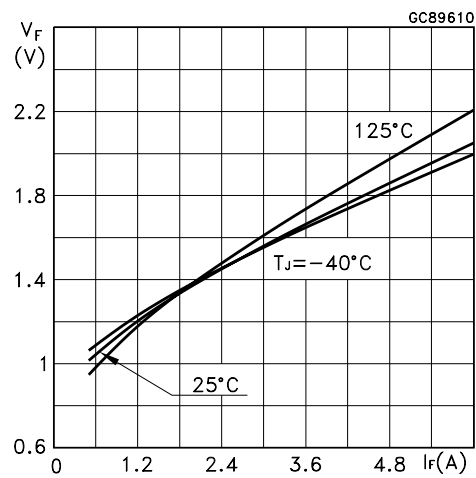
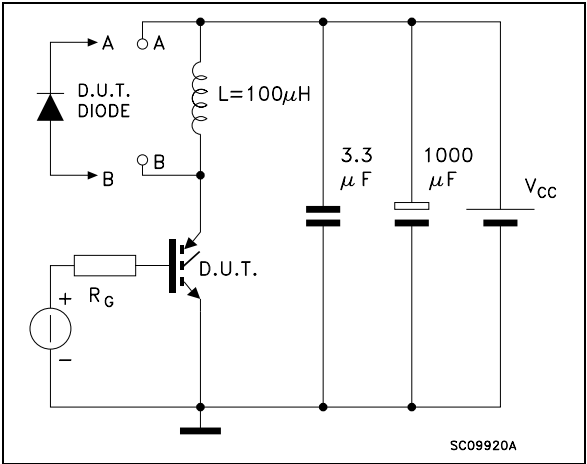
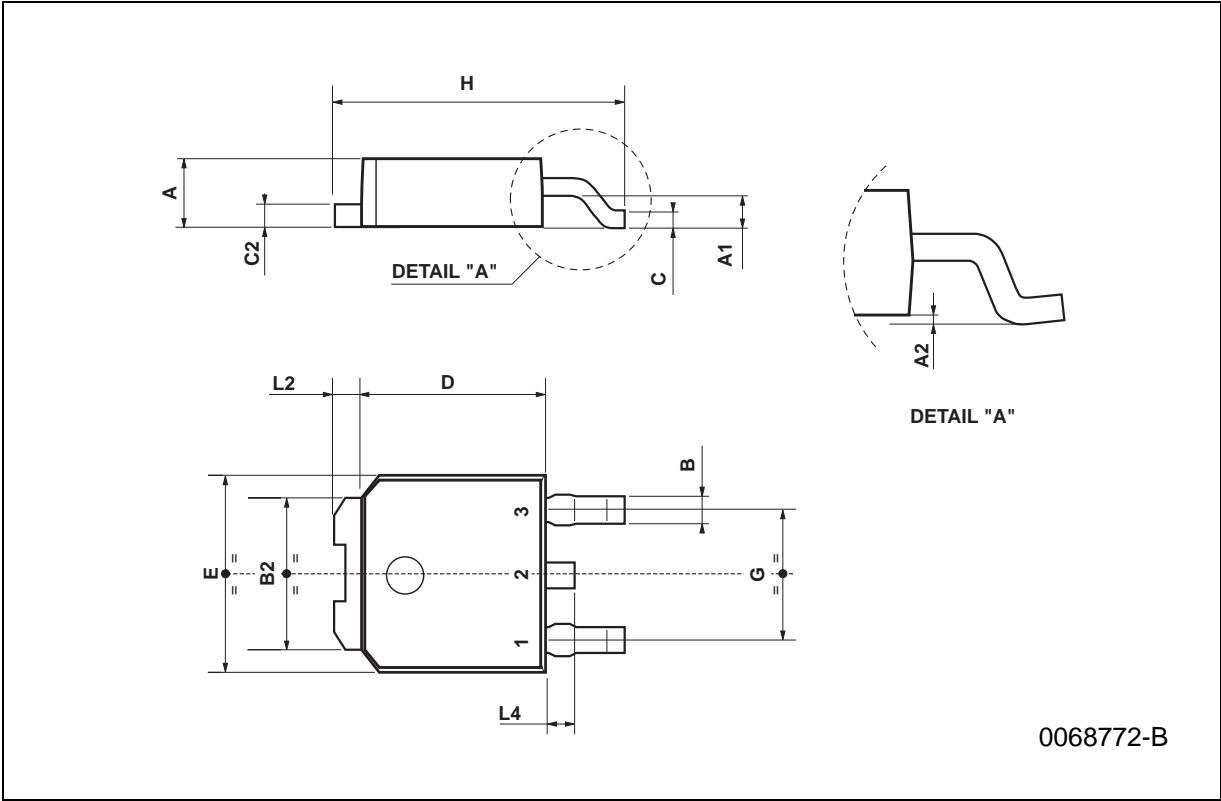


Fig. 2: Test Circuit For Inductive Load Switching



TO-252 (DPAK) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.9	0.025		0.035
B2	5.2		5.4	0.204		0.212
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
E	6.4		6.6	0.252		0.260
G	4.4		4.6	0.173		0.181
H	9.35		10.1	0.368		0.397
L2		0.8			0.031	
L4	0.6		1	0.023		0.039



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